Today’s children and those of the future will grow up in a dynamic multimedia environment. Researches show that virtual experiences result in changes of all psychological processes.

As the institution of teachers’ education, our goal is to prepare future teachers to be flexible and capable to follow educational needs of modern age.

Authors will try to give some of possible solutions to problem of adjusting of teachers’ role and educational process to cognitive needs of new generations that could be implement in primary schools. Also, there is given an analysis of didactical games as a way of learning based upon digital language.

Key words: digital generation, brain, education, didactic games, teachers

1. INTRODUCTION

A main world tendency today is development of modern information society. Children are also exposed to this tendency of development. Researches show enormous use of ICT’s by today’s children. Numbers are amazing – over 10,000 hours of game playing, over 200,000 received and sent mails and at the moment exchanged messages on Internet; over 10,000 hours spent in conservation by mobile, over 20,000 hours of watching TV, over 500,000 reviewed advertisements. And, maybe, at most 5,000 hours spent in books’ reading.

In the first part of paper we analyze differences between our digital children and their digitally accustomed teachers, who are, though, key source of all problems in today’s education. We can assume that brains of digital generation are physically specific because of their exposure to digital technology during development. This generation adopts knowledge, analytical abilities and values by digital technology mostly out of school. Also, technology influence on modeling of their personalities including attitudes in general and attitudes toward learning. It is also showed that different learning experiences affect development of brain’s parts. We could conclude by logic, that learning by digital technologies and usage of digital language is a good way to approach digital generation toward satisfaction of their educational needs.

2. NEUROPLASTICITY NEW PARADIGM

From point of neurosciences, teaching and learning are significant factors of psychological and neurological development of children. These aspects of development involve continued interactions between child and environment from individual cells to skin as obvious edge of person. Active and curious brain will develop stronger connections among its parts than brain as passive recipient of learning process. There might be some “sensitive periods” during development when certain groups of neurons become extra sensitive to stimulation. Absence of mental exercise may result in stoppage of some abilities’ development.
Brain neuroplasticity is a new paradigm. Although, most of today’s teachers believe that human brain doesn’t physically change under environment’s influences, generally after age of three years, researches show opposite. However, it is confirmed that new stimulus and new experiences constantly change a brain’s structure and affect a way of people’s thinking. These changes depend on intensive inputs and constant stimulation. Neuroplasticity means that brain literally restructures neural pathways throughout our lives – make new cells, create new connections; it sets up new neural circuitry and, as a result, constantly creates new thinking patterns.

One of pioneers in the field of neurobiological researches discovered that rats after two weeks in stimulating environments show some changes on brain in contrast to rats from non-stimulating environment. Sensitive parts of their brains became thicker and other parts heavier. So, brain develop and we can conclude that brain maintain neuroplasticity during the life time. This is just a beginning in understanding and application of researches from this field. Aim of most – including Scientific Learning Company – is education on basis of neuroscience.

Today we know that brain develop differently subject to exposure to different external stimulus, although we did not observed physical characteristics of digital brains. Some researchers describe our society as linear logical from left to right, from up to bottom, meaning that activity of left hemisphere dominates (Jukes, 2006). And new generations use both of hemispheres – left wich activities might become automic and right which activities are intuition, considering of whole,etc. Thus, consequence might be that digital technology connects and separate parts of children’s digital brains and a result is difference in information processing. Multimedial technology transfer information as a combination of sound, picture and interactive elements through right side of brain which is one of main tasks processing of visual information. For a long time, people unconditionaly belived to everything they see, so the right hemisphere process information mostly uncriticaly. At same time, left hemisphere, charged for writen and spoken language, carefully do cognitive process of information and is underestimated by technology.

However, brain and thinking patterns do not change over night. Important discovery about brain neuroplasticity is that reorganizing of brain isn’t simple. It requires time and hard work. Bio feedback need over 50 sessions for any results. Program of quick learning of Scientific Learning Company requires 100 minutes per day, 5 days per week during 5 to 10 weeks for desired changes because those changes need high concentration.

High concentration for few hours per day, five days per week – does this reminds you of something? Computers and videogames, of course! That is what children do in last 15 years. They adjusted their brain and programmed it to speed, interaction and other games’ factors in the same way how people adapted to written language and reading, or how generations of 50’s reprogrammed themselves to TV. When reading became main social determinant, one of primary tasks was adaptation of brain to language trained in a process of reading. This training includes high concentration for few hours per day, five days per week. Of course, when man found out how to train a brain for reading, he had to adapt it to TV. Now, things changed again and our children are trying to adapt to new thinking pattern that differ from old one. Children who grew up with computers developed hypertext minds as they have parallel cognitive structures that do not process sequentially.

Linear way of thinking dominates in an existing system of education and could make difficult learning for brain developed throughout computer games and Internet use. Some researchers assume that teenagers use different parts of brain and think in different way from adults when they use a computer. Today we know even more – their brains has to have different physiological configuration. Because of repeated stimulation some of brain’s areas are more developed or – repeated exposure to computer games and other digital medias.
results in development of multidimensional visual-spaced ability as reading of visual images in a frame of 3D space.

Psychological researches confirmed that people from different cultures do not just think about different things, but their thinking patterns are different (Sapir-Worf’s hypothesis). We thought that we all use same categories in same ways, that logic has same role in everyone’s understanding of everyday life, that memories, perception, implementation of rules are same for all. Now we claim that cognitive processes are much more adaptable than traditional psychology thought. Although, those cognitive processes are not novelty, but their combinations and intensity are novelties. Now we find ourselves in front of new generation with different and more developed combination of cognitive abilities – digital generation.

3. NEEDS OF DIGITAL GENERATION IN EDUCATION

Digital generation differs from ours for ways of thinking, but also for ways of access, absorbing, interpreting, process and use of information.

Digital sources of information provide learning based on experiences which is suitable for new generation. Actually, they desire to be actively engaged in constructing of their own knowledge based on collecting of information from different sources using different methods. These children quickly pick-up new devices and readily experiment with them, are capable for quick assessments and had adopted a mindset of rapid-fire trial and error learning. These operations seem to be characteristic for animals (rapid-fire trial and error learning doesn’t need intelligence), but it must not be forgotten that digital generation need learning based on experience. These students also want quick information and parallel processing and multitasking. By the time an adult has read the table of contents, the digital child has already figured out 15 things that will work and 15 things that won’t. Digital generation has extended capacity for parallel processing what requires ability of divided attention, probably of less intensity and less aimed to individual aspects. They also want immediate feedback and reward.

New children prefer visually or visual-kinetically represented information. Rather, they will memorize 10% of what they read, 50% of what they see and, almost, 90% of interactive information. They prefer visually parallel representing of image, text and sound as a way of information transferring within few seconds, same information from a book. Multimedia technology changed roles to text and picture. As previous, picture was a complement to text, now text is used to expand on something that has already been presented in image form. Greenfield (1996) speaks of the importance of "visual intelligence" and its intense development since the advent of television and multimedia. Thinking process of new generation is on a higher level than previous what is a direct consequence of digital attack and has significant impact on learning process.

Digital generation doesn’t want to be passive audience in a classroom. They want, expect and need interactive information, interactive sources, interactive communications and relevant life experiences. New non-linear learning methods and digital form of information is no challenge for them. By digital medias students are involved in researching of language, games, social interactions and self-organized education that support learning. Children differ on this process and these differences are observed in their attitudes, self-awareness, ways of creativity and independence and in an ability of systematic thinking.

New generation of students has poorly developed imagination, long-term memory, and non-verbal communication and is less patient. Long-term memory could be improved in several ways. Firstly, new information should be connected to something the student already knows and has already made meaning of. If there is no connection new information will stay in working memory for a few seconds. Secondly, teacher should provide context of reference
and relevance for new information. This means that learning is individually and that effective learning depends on its relevancy for a student. Third is that students are exposed to same content in regular time periods with different methods, from different sources and different aspects. Finally, students must be provided with regular and meaningful feedback and rewards. Digital generation does not respond to rewards in a form of advices but in a form of relevant experience.

We often hear from teachers that students have more problems with reading and thinking. Did digital generation lose some of skills in a process of “reprogramming”? A key field that has been changed is a field of cognition that enables us to make conclusions from mental models constructed from experience. We talk about “learning based on experience”. We have less time and opportunities for thinking and this is something we need to be concerned about. One of most interesting challenges and opportunities in teaching digital generation is to understand how to involve cognition and critical thinking in learning process (receiving instruction or getting any kind information from teacher) using digital generation’s language. System of education has obligation to solve this problem.

For successful processes of thinking, learning and reasoning is necessary high concentration. Teacher complain about low concentration of digital generation – “Of course they have low concentration for traditional way of teaching”, said one professor. They do not have problems with concentration for games or anything they are interested in. because of their experience, digital generation prefer interactivity – quick reaction to their activities. Traditional school offers little of this. For that reason, it is not true that digital generation can’t participate in traditional teaching, they refuse to do that.

Digital generation used to speed, parallel processing and multitasking, random access, activity, fun, fantasies, quick results of their world of games, TV and Internet find boring most of today’s educational programs no matter how they are benevolent. More serious problem is that teachers neglect most of skills that modern technologies stimulate and which are important to their process of learning. Cognitive characteristics of digital generation seek for new educational methods for them to adapt. This could be interesting to interpret that computer and video games are a way to reach educational needs of digital generation. For that reason, “digital learning based on games” emerged.

4. DIGITAL GAMES

Play is a human characteristic, the existence of games appears in the most wide-ranging of cultures. Until the end of the nineteenth century, games had been associated with entertainment. John Dewey (1944), gave games a major role in the teaching methodology. Games were introduced in the school as something more than just entertainment. The educators were intuitively aware of something that has been corroborated since then by numerous studies: that games have a major educational potential. Not only do they motivate, but they can help students develop skills, abilities, and strategies. This makes them an important part of teaching material in schools.

Many of educators and researches criticize didactical games. But, if some of didactical games don’t result in learning it is not because of games themselves or wrong concept of “learning through play”. It is because those games are not purposeful. There are many proves that purposeful didactical games provide knowledge.

Until some teachers are skeptical about learning based on computer games and give them negative connotation, those games are very helpful for digital generation. Finally, it is a medium that children are familiar with and enjoy it. Children approach to a problem similar to computer game – action with regular review with no plan of process. Considering this, teacher has to provide this kind of activity in purpose of stimulating thinking, development of planning strategies and solving of problems. If we exclude pauses in school and some of mid-
activities, school consists of three learning hours per day. If we assume that digital games are only 50% of importance for children’s education and if children play them for six hours per weekend conclusion is that children would devote one more day to education! Six hours are less than time digital generation would spend at home on weekend in watching TV or playing videogames.

Many of the existing theories have explained games on the basis of their function, that is, on what underlies the immediate experience of the game, both individually and socially. Calvo (1997) maintains that games can enhance the following functions:

- **Motor development.** Games often involve movement; they stimulate precision, coordination of movements, and speed.
- **Intellectual development.** As well as movement, games may also involve understanding how things work, resolving problems, devising strategies, etc.
- **Affective development.** The fictional nature of games, the opportunity to act out a role means that they have a key function in the affective development of the individual. Games stimulate students to understand their life experiences and help them to mature.
- **Social development.** Games are also ways of relating to others. In addition to their socializing dimension, their capacity to symbolically generate roles makes them effective transmitters of society’s predominant values and attitudes.

Therefore, right solution is to make such didactical games that would be enough interesting to replace TV and videogames. These games should respond to reality, and not to be part of a drill as nicely designed teaching material. Good example is a Program of quick learning of Scientific Learning Company. This program is based on games for education of children with reading problems. Research was conducted by 60 independent experts on 35 locations in USA and Canada. Results of standardized tests showed Program’s efficiency by improvement of reading in 90% of children.

Nussbaums research is also interesting conducted with pupils from fourth grade in primary school (Nussbaum, 1999 in Gross, 2003). The team created a series of adventure games that complemented basic educational items in language and mathematics. Each game was a story that included specific characters and interactions, but all shared certain common basic elements: the way the task was presented and how it was resolved, positive or negative feedback at the end of the task, interaction with rival characters, rewards, and assigning a score. Nussbaum’s team found the children to be highly motivated from the very beginning — both those who were familiar with this type of technology and those who had no access to it outside school. Results also show that didactical games contributed to development of digital literacy – comprehension of computer’s instructions and procedure, but also development of strategies for solving linguistic and mathematical problems. Their opinion at the end of the experiment was positive; they considered the video game to be an easy-to-use educational instrument with potential as backup to other teaching material.

Every time we talk about learning process, we talk about exercise. But children don’t like exercise. Games keep their attention and simply work. Of course, children have to exercise some things and games need to be purposeful. American armies, which educate 2.500.000 young people, deeply believe that didactical games are the way to approach a digital generation.

That is why now neurobiologists and social psychologies agree that brain change under influence of stimulates from environment. Teachers who educate children with special needs and army use specific purposeful didactical and video games to satisfy needs of digital generation in education. Most of teachers who use traditional approach to education don’t rush to follow others. Teachers know something is wrong because they can’t activate digital
generation as they managed to do with previous generations of students and find themselves being forced to decide.

On one side, they can decide to neglect what their eyes, ears and intuitions tell them, pretend there is no gap between them, as digitally accustomed, and digital generation of children and continue to use their, less useful, traditional methods of teaching and retire when digital generation take over a control. On the other side, they could accept the fact that learning based on games is the way to translate own knowledge and skills into language of modern age with aim of education of digital generation who don’t react to traditional way of teaching.

Maybe Squire (2002) is right when, looking at the range of values and powers that educators ascribe to games, describe games as projection of educators’ attitudes toward modern social, technological, and media change, rather than an emerging and maturing entertainment medium.

5. CONCLUSION

Digital generation puts great demands and challenges to existing system of education. Today’s children use digital language and we could say it is their “native tongue”. According to this, today’s teachers have to learn this new language in due to understand needs and abilities of new generation. For that reason, teachers are, so called, “digital immigrants”. Problem emerges when students notice teachers’ “bad accent” and they began to suspect in their competency. Solution is digital literacy of teachers.

Digital material can’t and shouldn’t replace books, pencil and paper, face-to-face interaction and other ways of socialization, learning and communication. However, new teaching and learning material should be included in education because they change expectations of new generations of students. Focus of modern education is a student unlike traditional education’s focus on teacher. Teaching process should be a result of active engagement and collaboration between teacher and student. Students also have to answer demands to suspect everything they see and hear, to be active in discussion, to make a synthesis of everything they learn and manifest own creativity in all they make.

There is no doubt that digital generation of students provokes new approach to teaching process – seemingly chaotic, constructive process focused on parallel processing and multitasking against formal, linear process focused on teacher. If we really want to improve quality of life to digital children than school must become a place where students are actively engaged in constructing their own knowledge and know how, develop logical thinking and the ability to apply key content concepts and ideas, actively explore and discover, pose questions and give answers, solve problems, engage in complex tasks that enable them to address essential questions and participate in the process that make up intellectual accomplishment, span different media, link different disciplines, have more than one right answer, multiple routes to each of these answers, an understandable purpose and a connection to the real world. Traditional education tried to answer on question “what?”, but digital generation needs education that will also answer on questions “when?”, “where?”, “how?” and “why?”.

If we compare educational needs of digital generation and reality in education (traditional bases of education) we got following:

- Digital generation prefer receiving info quickly from multiple multimedia sources – many teachers prefer slow and controlled release of info from limited sources
- Digital generation prefers parallel processing and multi-tasking - many teachers prefer singular processing and single/limited-tasking.
Digital generation prefers processing pictures, sounds and video before text - many teachers prefer to provide text before pictures, sounds and video.

Digital generation prefers random access to hyperlinked multimedia information - many teachers prefer to provide information linearly, logically and sequentially.

Digital generation prefers to interact/network simultaneously with many others - many teachers prefer students to work independently rather than network and interact.

Digital generation prefer to learn “just-in-time” - many teachers prefer to teach “just-in-case” (it’s on the exam).

Digital generation prefers instant gratification and instant rewards - many teachers prefer deferred gratification and deferred rewards.

In education of digital generation and in respect of their needs, accent should be on development of critical thinking and ways of its oral and written manifestation, development of communicational skills and referent and relevant content in real life context.

Digital generation put teachers in a position between present and future, between fulfillment and failure. But, we have to decide what do we want? Do we want to unfold intellectual and creative potential of our children in order to prepare them for modern society and their future, but not our past? If we want to do this, we have to establish connection between their and our world with significant help of technology. First step in this process is a change and expansion of teacher’s role and competence.

LITERATURE:


